APPLICATOR AND DISPENSING DEVICE USING SAME

Field of the Invention

The present invention relates to an applicator for dispensing and applying fluid products to a desired object, and to a dispensing device for mixing and dispensing fluid components under pressure from a plurality of containers to provide a combined multi-component product that may be directly applied to a desired object.

Background Information

It has long been known to dispense a single-component fluid product under pressure from an aerosol or pump-type container or the like. Various types of dispensers are also known which are capable of dispensing a multi-component product by means of the ejection and mixing of two different fluid constituents from separate containers. For example, U.S. Patent No. 4,773,562 discloses a dispenser of the latter type, which is used for dispensing a two-component self-heating shaving cream comprising a first component including a reducing agent and a second component including an oxidizing agent reactive with the reducing agent to liberate heat.

Dispensing devices that provide for the simultaneous release of materials from two containers in response to the pressing of a valve release button or actuation of a pump generally include tubes, ducts, or similar structure for conveying each of the two materials from the respective containers to a mixing chamber at which the materials are combined, the mixing chamber having a single outlet port or nozzle at which the mixture is dispensed. In U.S. Patent No. 4,773,562, for example, a dispensing head is provided with a Y-shaped groove having lateral arms for separately conveying materials dispensed from two different containers to a median arm, where the two materials are mixed and conveyed as a combined product to a single outlet nozzle.

Various types of applicator structures are also known which are formed on, or mountable to, a single pressurized dispensing container for converting a stream of a dispensed product into a form more useable for a given application. In the hair care field, for example, one type of known applicator consists of an appliance having a comb or brush type structure mountable on a pressurized dispensing container. This type of device has internal conveying means for conveying a hair treatment fluid from a nozzle of the pressurized dispensing container to one or more outlet ports to enable the direct application of the hair treatment fluid to the user's hair. This type of device has been made available for use with products such as shampoo, conditioner, styling formula, and hair dye to enable one-hand use and easy manipulation by a consumer or stylist.

However, in fluid application processes requiring the use of a multi-component product that must be mixed immediately before application to a given object, none of the known devices is capable of dispensing, mixing and applying such products in a satisfactory manner. For example, in the use of multi-component hair dye products, the user or stylist is generally required to carefully perform a number of manual operations to properly mix the individual components before applying the mixture to the hair. This series of operations commonly includes steps of transferring a chemical dye agent from a first container into a second container containing an activating agent to produce a mixture, removing an applicator from the second container to permit proper outgassing of the mixture, sealing the second container, shaking or agitating the second container containing the mixture to assure proper mixing of the chemical agents, unsealing the second container, reinstalling the applicator on the second container, applying the mixture to a selected portion of the hair to be treated, and dispersing the mixture

throughout the hair to ensure an even application of the dye. During the performance of each of the foregoing steps, the consumer or stylist is usually required to wear safety gloves to prevent staining of the hands, clothing and surrounding area. However, since the safety gloves become covered with the dye, the problem of staining is seldom avoided.

The series of operations required in the use of conventional multi-component hair dying systems are not only awkward, dirty and inconvenient, but are disadvantageous from the standpoint of safety. Moreover, outgassing of the mixture is generally accompanied with unpleasant odors associated with harmful chemicals.

Summary of the Invention

In view of the foregoing disadvantages of the prior art, an object of the present invention is to provide a dispensing device for controlling the coordinated mixing and dispensing of a plurality of fluid constituents.

Another object of the present invention is to provide a novel and improved dispensing device for mixing together a plurality of fluid constituents and directly applying the mixture to a desired object.

Still another object of the present invention is to provide a novel and improved dispensing device simple in manufacture and which may be easily cleaned by the consumer, in which a plurality of fluid constituents may be kept under pressure in separate reservoirs until immediately prior to use, and which releases the constituents in a controlled manner for mixing and discharge.

Yet another object of the present invention is to combine a dual-component dispensing device for the mixing and dispensing of two fluid constituents with an applicator for directly applying the mixture of fluid constituents to a desired object and dispersing the mixture over the surface of the object.

Still yet another object of the present invention is to provide a novel and improved hair care accessory for use in mixing and dispensing a plurality of fluid hair care products and which has an applicator with a plurality of tines arranged in a matrix for directly applying and dispersing the mixture throughout the hair without the need for wearing safety gloves.

A further object of the present invention is to provide an applicator having tines or teeth, some of which have internal ports connectable to a source of product to be dispensed, for uniformly applying the product to a desired object, such as a person's hair.

Another object of the present invention is to provide an applicator having internal passageways which are connected at one end to a source of product to be dispensed and which are connected at their other end to internal ports formed in tines or teeth on the applicator to enable dispensing of the product through the tines or teeth.

In order to achieve the foregoing objects as well as others which will be readily apparent to those of ordinary skill in the art, the present invention proposes a dispensing device capable of mixing, dispensing and applying a plurality of fluid constituents. The dispensing device of the present invention is intended for use with a plurality of valved fluid containers containing fluid constituents, the dispensing device comprising a mixing chamber having a plurality of inlet ports for receiving the individual fluid constituents discharged from the containers and a mixing passageway for mixing together the fluid constituents, and an applicator having one or more fluid outlet ports for dispensing and applying the constituent mixture to a desired object. The dispensing device permits the coordinated mixing, dispensing and application of a plurality of fluid constituents to a desired object in a single, easily-manipulable operation

which may be performed by a one-hand operation without the need for wearing safety gloves.

In the case of multi-component hair dye systems, for example, the applicator is preferably in the form of a comb matrix having internal passageways for conveying the mixture from the mixing chamber to the one or more outlet ports. Selected ones of the tines or teeth of the comb matrix are preferably hollow with an opening at the distal end thereof for dispensing the mixture onto the hair. The tines or teeth of the comb matrix are used to dispense and apply the mixture throughout the hair to produce a uniform coating of the hair dye throughout the user's hair.

Preferably, the applicator and the mixing chamber are provided in the form of an applicator head that may be removably mounted on a pair of aerosol-type containers by means of a snap-fit or frictional engagement. In a preferred embodiment, the containers comprise aerosol-type containers each having a first compartment containing one of the constituents of a two-constituent mixture and a second compartment containing a propellant for dispensing the constituent upon the pressing of a valve release member. The applicator head has a depressible button-type valve release member for simultaneously pressing the valve stems of the aerosol-type containers to discharge the constituents from the containers for delivery to the mixing chamber.

Alternatively, the containers may be pump-type containers each having a single reservoir containing one of the constituents of the two-constituent mixture, and a pump mechanism for dispensing the constituents upon the activation of a pumping member. The applicator head has a depressible button to effect the simultaneous activation of the pumping members of the pump-type containers.

In order to facilitate ease of manufacturing and cleaning, the applicator head including the applicator and the mixing chamber are preferably formed of two

complementary parts fitted together, including a first part provided with means adapted to cooperate simultaneously with valve actuating elements of the fluid containers for causing the ejection of the constituents of the containers into respective inlet ducts leading to the mixing chamber. The mixing chamber effects intermixing of the constituents and delivers the mixture through a plurality of outlet ports to the applicator.

To obtain proper mixing of the fluid constituents, the mixing chamber is preferably shaped to provide a mixing passageway in the form of a tortuous flow path for the flow of the fluid constituents between the meeting point of the two constituents in the mixing chamber and the plurality of outlet ports, thereby ensuring a thorough and uniform intermixing of the two constituents. Preferably, a sinuous flow path or a spiral flow path is utilized to obtain the desired intermixing flow, such path being obtained by at least one baffle carried by at least one of the first and second parts which constitute the mixing chamber.

The outlet ports of the mixing chamber are preferably disposed in an open, unobstructed portion of the mixing chamber disposed at the end of the tortuous flow path. Preferably, the applicator is disposed adjacent to the mixing chamber and has a plurality of dispensing tubes extending from the outlet ports of the mixing chamber for dispensing the mixture onto a desired object.

The applicator may be provided with a surface effective for the direct application of the mixture to a desired object. In the case of a hair care appliance, for example, the applicator is preferably provided in the form of a comb matrix, the plurality of dispensing tubes serving as tines or teeth of the comb matrix.

The mixing chamber may have a tortuous flow path that terminates in a single outlet at a nozzle tip portion of the applicator, and a series of baffle mixing stations

may be positioned along the flow path to create localized turbulence to promote intermixing of the constituents.

The fluid constituents are conveyed from the containers to the inlet ports of the mixing chamber through passageways which may be constructed to provide an identical path length for the two flows from the containers to the mixing chamber, or, may be shaped so as to provide different length paths for the two flows, depending upon the characteristics and viscosity of the respective fluid constituents.

Brief Description of the Drawings

Figure 1 is a front view of a dispensing device according to a first embodiment for the dispensing of doses of a product resulting from the mixing in a mixing chamber and dispenser head of two different pressurized constituents;

Figure 2 is a top view of the dispensing device of Figure 1;

Figure 3 is a side cross-sectional view of the dispensing device of Figures 1 and 2, taken along line 3-3 of Figure 2, to illustrate the cross section of the fluid reservoirs and the lower portion of the applicator head along a center line of the fluid reservoirs, and to illustrate the cross section of the upper portion of the applicator head at a center line thereof;

Figure 4 is a view of the internal structure of the mixing chamber;

Figure 5 is a view of the internal structure of a mixing chamber of an applicator head in accordance with a second embodiment of the present invention;

Figure 6 is a front view of one embodiment of an applicator;

Figure 7 is a side view, with back plate removed, of the applicator of Figure 6;

Figure 8 is a rear view of the applicator of Figure 7, with the back plate removed to show the fluid ports and passageways;

Figure 9 is a cross-sectional view of the applicator of Figure 6, with the back plate attached, and showing the applicator with a handle and connected to a source of product to be dispensed;

Figure 10 is a front view of another embodiment of an applicator;

Figure 11 is a side view, with back plate removed, of the applicator of Figure 10;

Figure 12 is a rear view of the applicator of Figure 11, with the back plate removed to show the fluid ports and passageways;

Figure 13 is a cross-sectional view of the applicator of Figure 10, with the back plate attached, and showing the applicator with a handle and connected to a source of product to be dispensed;

Figure 14 is a front view of another embodiment of a dispensing device according to the present invention;

Figure 15 is a top view of the actuator, with the applicator head removed, of the embodiment of Figure 14;

Figure 16 is a view of the inside of one of the two sections of the applicator head of the embodiment of Figure 14; and

Figure 17 is a side view, partly in cross section, of the applicator head of the embodiment of Figure 14.

Detailed Description of the Invention

Embodiments of the dispensing device according to the present invention will be described by way of example with reference to a hair treating appliance. The invention is not, of course, so limited to a hair treating appliance and extends to, encompasses and covers dispensing devices for mixing and dispensing virtually all types of fluid constituents. As used herein, the term "constituent" means

the contents within one container which is to be mixed and dispensed with the contents of one or more other containers without regard to the number of individual ingredients making up the constituent. As used herein, the term "fluid constituent" means a constitutent having sufficient fluidity to be flowable and dispensed from a container and includes liquids, creams, gases, entrained powders and the like.

One embodiment of a dispensing device 10 in the form of a hair treating appliance is shown in Figures 1-4. The dispensing device 10 is removably attachable to a pair of containers 12a,12b and is operable, when actuated, to effect the simultaneous ejection of the constituents of the two containers, convey the constituents to a mixing chamber wherein the constituents are uniformly intermixed and delivered to an applicator for dispensing the constituent mixture. The two containers 12a,12b are preferably housed in a case 11. While in the disclosed embodiment the dispensing device 10 is constructed for use with two containers, the device is equally applicable for use with three or more containers. The dispensing device 10 is preferably attached to the containers 12a,12b by a snap-fit or other frictional engagement, whereby the dispensing device can be easily removed from one set of containers and removably attached to another set.

The containers 12a,12b may be any type of fluid containers, including aerosol containers of the piston type using a polyethylene, polypropylene, or a more sophisticated polymer barrier structure molded or thermoformed as a piston disposed between a propellant such as a hydrocarbon, compressed air (CAIR) or nitrogen, and a product to be dispensed. The containers 12a, 12b may also be of the so-called bag-in-can type having an inner container such as a bag or pouch that attaches to either of the top seam of the can or the can curl. Another type of bag-in-can system is one in which the bag is attached to

the tailpiece of the valve. Such containers may comprise aluminum tri-laminate bags wrapped tightly to resemble cigars, pre-attached to the valve, and slipped into the empty can during valve-poking. One such can, the P-type bag-in-can system produced by Toyo Aerosol Industry Co., Ltd. of Japan, consists of a relatively thick-walled vertically fluted LPDE, HDPE, or laminated bag, the top area of which is made integral with a special nominal 22mm valve.

As will be appreciated by those of ordinary skill in the art, the containers 12a,12b are not limited to aerosol-type containers. For example, pump-type containers may also be used. Such containers usually have an overall cylindrical shape similar to that of an aerosol container and are provided with dispensing means in the form of a pump mechanism disposed at the top of the container. In pump-type containers, the product to be dispensed is not ejected through the nozzle of the pump by means of a propellant stored within the container, as in aerosol-type containers, but is ejected by means of the repeated pumping movement of a pump member located at the top of the container.

As should also be appreciated, any other type of fluid containers may be used with the dispensing device of the present invention, and the type, size, shape and geometry of the containers used in the preferred embodiments disclosed herein are neither critical nor essential aspects of the invention. While the applicator head assembly described herein is designed to accommodate a pair of cylindrical aerosol-type containers, this is not intended to limit the scope of the invention or the appended claims to any particular configuration.

The containers 12a and 12b have the same construction, though store different constituents. Therefore only one container will be described in detail,

it being understood that the other container is of similar construction.

The containers 12a and 12b are of conventional construction and for explanatory purposes only and not by way of limitation, the invention will be described with reference to aerosol containers. As shown in Figures 1 and 3, the aerosol container 12a comprises a container body having a generally cylindrical sidewall 13, a closed lower end or bottom 14 and an upper end or top which is closed by a valve carrier cup 15. The valve carrier cup 15 is fixed by crimping or other means to the upper rim 16 of the container body.

The valve carrier cup 15 carries a valve or valve assembly 17 for dispensing the constituent within the container 12a. The valve 17 comprises a movable valve member 18 having a central axial throughbore 18a and a plurality of radial openings 18b for communicating the interior of the container 12a with the central throughbore 18a when the valve member 18 is depressed, as described in more detail hereinafter. The valve member 18 has a stepped configuration having a narrower upper portion which slidably projects upwardly through an opening in the valve carrier cup 15, and a wider lower portion which abuts against and seats on a valve seat 19 affixed to the valve carrier cup 15. The valve seat 19 surrounds the upper portion of the valve member 18 and is composed of a material suitable to maintain a fluidtight seal with the outer periphery of the valve member 18 while permitting repeated sliding movement of the valve member. A tubular support member 20 surrounds the lower portion of the valve member 18 and is fixed by bonding or other means to the valve seat 19 and/or to the valve carrier cup 15. Biasing means such as a compression spring 21 is disposed within the tubular support member 20 for normally urging the valve member 18 upwardly to its closed position (Figure 3). The compression spring 21 is disposed in a compressed state

between the lower end portion of the valve member 18 and an inner wall portion 20a of the support member 20. The lower end of the support member 20 has an axial throughbore 20b for permitting entry of the constituent into the interior of the tubular support member 20, from which the constitutent is ejected through the valve 17 to the dispensing device 10.

In operation, when the valve member 18 is depressed downwardly against the upward biasing force exerted by the compression spring 21, the radial openings 18b are brought into communication with the interior of the container 12a through the axial throughbore 20b and the interior of the tubular support member 20, thereby delivering the constituent from the container 12a through the axial throughbore 20b to the dispensing device 10 where the constituent is mixed with the constituent delivered from the other container 12b. When the depressing force is removed from the valve member 18, the compression spring 21 urges the valve member upwardly to its closed position shown in Figure 3, wherein the radial openings 18b no longer communicate with the interior of the container 12a. If desired, radial openings (not shown) may also be provided in the sidewall of the tubular support member 20 upwardly of the wall portion 20a to facilitate the flow of the constituent to the radial openings 18b when the valve member 18 is depressed.

It will be understood by those ordinarily skilled in the art that any conventional type valve assembly can be employed for dispensing the constituents from the containers 12a and 12b in response to downward actuation. The valve assembly 17 and its associated structure have been described herein only by way of example and not by way of limitation.

The dispensing device 10 comprises an applicator or dispensing head 25, a mixing chamber and an actuator.

The applicator head 25 is comprised of two complementary parts 26, 28, which are preferably molded of a relatively rigid opaque plastic material. The first part 26 is fitted directly onto the upper ends of the two containers 12a, 12b and carries a manually depressible actuator for discharging the constituents from the containers, and the second part 28 mates with the first part 26 and defines the mixing chamber and applicator head 25.

The first part 26 comprises a base plate 30 delimited, when the first part 26 is in its fitted position on the containers 12a, 12b, by a bottom wall 32, a top wall 34 and a lateral sidewall 36. To the base plate 30 there is joined a peripheral skirt 38 having an inner wall 40 aligned with the lateral wall 36 and which is configured to receive the upper ends of the containers 12a, 12b and to mate with the case 11, the applicator head 25 thus being mounted for sliding engagement in relation to the case 11.

The inner wall 40 of the peripheral skirt 38 is provided with a flange 42 extending around the periphery of the inner wall 40. The flange 42 is designed to engage with an upper lip 44 of the containers 12a, 12b in a snap-fit engagement such that when the applicator head 25 is placed over the containers 12a, 12b and an adequate force is applied between the applicator head 25 and the containers 12a, 12b, the flange 42 engages the upper lip 44 of the containers 12a, 12b due to the resilient nature of the rigid plastic material forming the applicator head 25.

The bottom wall 32 of the first part 26 has two small cylindrical recesses 46a, 46b whose axes are perpendicular to the bottom wall 32. These recesses are positioned in such a way that when the applicator head 25 is mounted in position on the containers 12a, 12b, the upper ends of the valve members 18 of the containers 12a, 12b are snugly received in the respective cylindrical recesses 46a, 46b. Two inlet ducts 48a, 48b are formed in

the first part 26, the ducts being bounded by the top and bottom walls 32 and 34. As shown in Figures 2 and 3, the two inlet ducts 48a, 48b communicate at one end with respective ones of the central throughbores 18a of the valve members 18, and merge together at their other ends and communicate with a common inlet port 49 leading to a mixing chamber 56.

In the top wall 34, a manually depressible actuator button 50 is provided to cause the base plate 30 to undergo downward movement with respect to the containers 12a, 12b to thereby downwardly displace the valve members 18 upon application of sufficient downward pressure to the actuator button 50 to simultaneously release the pressurized constituents from the respective containers 12a, 12b, as shown by the arrows in Figure 3. Upon the release of downward pressure from the actuator button 50, the bias springs 21 of the valves 17 exert an upward force on the respective valve members 18 to close the valves 17 of the containers 12a, 12b and thereby stop the release of contents therefrom.

The second part 28 of the applicator head 25 may be fitted to the first part 26 by means of a frictional engagement. When the two parts 26, 28 of the applicator head 25 are fitted to each other, a rim portion 52 of the first part 26 engages with a peripheral ledge portion 54 of the second part to retain the first and second parts 26 and 28 in fitting engagement. In a preferred embodiment, the second part 28 is provided with an annular lip 55 which surrounds the ledge portion 54 and which frictionally engages with the rim portion 52 of the first part 26 to maintain the two parts 26 and 28 in operative engagement. If desired, an adhesive or other bonding agent can be applied to the mating surfaces of the rim portion 52 and ledge portion 54 to permanently connect the rim and ledge portions.

Referring now to Figure 4, a view of the second part 28 can be seen in which the second part 28 has been removed from the first part 26 to illustrate the internal construction of the second part 28, namely, the construction of the internal mixing chamber 56 at which the two constituents ejected from the containers 12a, 12b are mixed. As noted above, the first part 26 is provided with two inlet ducts 48a, 48b for conveying the constituents from the respective containers 12a, 12b to the common inlet port 49. As illustrated in Figure 4, the second part 28 has an inlet region 58 in alignment with the inlet port 49 of the first part 26, at which the individual flows from the inlet ducts 48a, 48b combine and are input to the mixing chamber 56. The mixing chamber 56 has a tortuous flow path defined by a baffle 60. The combined constituents enter the mixing chamber 56 at the inlet region 58 and flow along a sinuous path defined by the baffle 60 for a considerable distance, while undergoing repeated deflection by individual baffle members 61 of the baffle 60, to effect progressive mixing of the individual constituents so that the mixture of constituents becomes increasingly uniform and homogeneous as it flows along the sinuous flow path. The mixed constituent product ultimately reaches an open area 62 of the second part 28 at which it disperses and is ejected through plural outlet ports 64. The path of flow of the individual constituents and the combined constituent product is illustrated by arrows in Figures 3 and 4.

The mixing chamber 56 thus comprises the opposed, confronting surfaces of the first and second parts 26 and 28 and the baffle 60 which, in this embodiment, is formed on the second part 28. After flowing completely through the sinuous path, the constituent mixture is ejected from the outlet ports 64 to provide a properly mixed composition without the need for the manual operations associated with prior art hair dye systems.

Although the baffle 60 is formed entirely on the second part 28 while the mating surface 66 of the first part 26 is smooth, all or part of the baffle 60 may instead be formed on the mating surface 66 of the first part 26, so long as when the first and second parts 26, 28 are fitted together in the manner described above, a mixing chamber is provided with an elongated tortuous flow path effective to assure proper mixing of the fluid constituents ejected from the first and second containers 12a, 12b.

Another embodiment of an internal structure of a mixing chamber is shown in Figure 5. In this embodiment, the tortuous flow path has the configuration of a spiral path defined by a spiral baffle 60a. An inlet port 49a of the first part 26 opens at the center of the spiral path, and the two constituents ejected from the containers 12a, 12b combine at the inlet port 49a and intermix with one another as the constituents flow along the spiral flow path to outlet ports 64a.

Other baffle configurations will become apparent to those ordinarily skilled in the art to obtin a tortuous flow path effective to thorougly intermix the individual constituents during their combined flow through the mixing chamber. Moreover, as described below with reference to the embodiment shown in Figures 14-17, one or more baffle mixing stations may be employed along the tortuous flow path to creat flow separation and turbulence to enhance intermixing of the constituents.

As should also be appreciated, formation of the applicator or dispensing head 25 in separable first and second parts 26 and 28 permits ease of manufacturing by means well known to those of ordinary skill in the art, such as by injection molding, thermoforming, or the like. This construction also permits easy assembly and simple cleaning of the inside of the applicator head 25. However, the applicator head may instead be formed of a single,

unitary component, or may be formed of more than two separable components.

When the first and second parts 26 and 28 are fitted together in the manner described above, the inlet ducts 48a, 48b, mixing chamber 56, open area 62 and outlet ports 64 provide a path of continuous flow for the material ejected from the first and second containers 12a and 12b. This assists in perventing clogging of material and facilitates cleaning of the applicator head after use.

When the user desires to dispense a quantity of mixed product, he or she positions the applicator head 25 above the containers 12a and 12b with the respective valve stems 18 aligned with the recesses 46a, 46b. Then the applicator head and containers are brought towards one another until the flange 42 of the applicator head 25 engages the lips 44 of the containers 12a, 12b. Thereafter, the user depresses the actuator button 50 to simultaneously displace the two valve stems 18 downwardly to open the valves 17 and permit the constituents to be ejected from the containers 12a and 12b and flow through the inlet ducts 48a, 48b and the common inlet port 49 into the mixing chamber 56. After the two individual flows have come together, the mixing of the two flows is obtained in the mixing chamber 56 before the combined product is ejected through the outlet ports 64 of the mixing chamber 56 to a comb portion 68, a detailed description of which is given below in conjunction with the description of the applicators shown in Figures 6-13. The comb portion 68 is then used to disperse and apply the ejected product throughout the hair. Thus, the steps of dispensing, mixing and applying a dual-agent hair dye are performed in a single operation using the apparatus of the present invention.

As will be appreciated by those of ordinary skill in the art, a multitude of fluid constituents of differing viscosities, flow rates, densities and other

characteristics may be accommodated in the multi-container dispensing system of the present invention to achieve a desired combined product by means of mixing. Products such as oils, epoxies, cleaning fluids, waxes and the like, may be used. Similarly, hair treatment products other than dyes may be used, including products intended for human and animal use such as relaxers, straighteners, conditioners, and formulae intended to treat scalp conditions and other problems such as hair lice, fleas, and the like. In order to accommodate constituents of differing viscosity and physical characteristics, various modifications may be made within the scope and spirit of the present invention, such as by varying the size or type of the containers, varying the size or length of the inlet ducts, mixing chamber, or outlet ports, varying the applicator structure or fluid passageways to accommodate a particular product or application, and the like. One or more baffle mixing stations may be disposed along the tortuous flow path, as in the embodiment of Figures 14-17, depending on the constituent characteristics and other factors. Delivery rates can easily be adjusted by changing the propellant used in the aerosol containers or the valve and mixing chamber specifications.

In accordance with another aspect of the invention, an applicator is provided for dispensing and applying a fluid product. The applicator may be used for dispensing single constituent products from one source or pre-mixed constituent products from multiple sources.

The applicator is a portable hand-held unit which, during use, is connected to a source of product to be dispensed. The applicator may be of the same or similar construction as the applicator heads described above, and the mixing chamber may be omitted from the applicator heads if no mixing of products is desired. In such a case, the applicator head 25 would be modified to provide a coupling or connector at the region of the inlet port 49 to enable

connection of the applicator to a source of product to be dispensed. The baffle 60 may be omitted to provide less obstruction to the flow of product.

One embodiment of an applicator 70 according to the present invention is shown in Figures 6-9. The applicator 70 comprises a portable hand-held unit having a base portion 71 and comb portion 72, the comb portion 72 being the same as the comb portion 68 shown in Figures 1-4 insofar as concerns the structure and function of the teeth or tines. As shown in Figure 9, the base portion 71 comprises a base plate 74 and a coupling or connector 75 for enabling removable connection of the applicator 70 to a dispensable source of product. The coupling or connector 75 may have threads or other fastening elements which mate with complementary fastening elements on a conduit connected to the outlet of the source of the product.

The comb portion 72 comprises a plurality of teeth or tines 76 arranged in any desired configuration and projecting outwardly from a front face of the comb portion 72. The teeth or tines 76 (hereafter referred to as simply tines) consist of solid tines 76a and hollow tines 76b in this embodiment, the hollow tines 76b having a slightly shorter length than the solid tines 76a. As shown in Figure 9, the comb portion 72 has a front support wall 77 to which are connected the tines 76 and a peripheral side wall 78 connected to the front wall 77. The rear edge of the side wall 78 has an annular recess defined by a ledge 80 and a lip 81 for receiving therein, preferably with a snap-fit, the base plate 74. A suitable bonding agent, such as an adhesive or the like, may be applied to the mating surfaces of the base plate 74 and the ledge 80 to permanently connect the base portion 71 to the comb portion 72.

As shown in Figures 8 and 9, a partition wall 84 is provided on the rear face of the front wall 77. The partition wall 84 surrounds outlet openings 85 which open

into the hollow tines 76b, and the partition wall 84 is configured to surround a central inlet opening 86 defined by the connector or coupling 75 when the base portion 71 is fitted to the comb portion 72. The partition wall 84 defines flow passages for the product to be dispensed, guiding the product from the inlet opening 86 to the outlet openings 85 so that the product flows through the hollow tines 76b and is discharged from outlet ports 87 at the distal ends thereof.

The applicator 70 is configured to be held by the hand of a user and manipulated in the same manner as a brush or comb. If desired, a handle 88 may be attached to the applicator 70 to facilitate use thereof. In operation, a source of product to be dispensed is connected by means of a conduit or the like to the connector or coupling 75. The user grasps the applicator 70, or the handle 88, and positions the applicator in proximity to a person's hair which is to be treated. The user then discharges the product from the source, whereupon the product flows through the inlet opening 86 into a receiving chamber defined by the partition wall 84. The product is guided by the partition wall 84 and flows through the outlet openings 85 and through the hollow interiors of the hollow tines 76b. The product is discharged from the outlet ports 87 at the distal ends of the hollow tines 76b onto the person's hair while the applicator 70 is manipulated to apply the product, as desired, by means of the tines 76. The shorter length of the hollow tines 76b facilitates dispensing of the product while enabling the longer tines 76a to penetrate deeper through the person's hair to enable the product to be easily applied while it is being dispensed. Of course, the shorter tines 76b also assist in applying the product in conjunction with the longer tines 76a.

Figures 10-13 show another embodiment of an applicator 90, which is similar to the applicator 70 shown in Figures 6-9 except for the location of the coupling or

connector and the arrangement of the partition wall. In this embodiment, a coupling or connector 92 is located near the bottom of the applicator 90, and a partition wall 94 is configured to provide flow passages for directing the product from an inlet opening 95 to inlet openings 96 of the hollow tines. In other respects, the applicator 90 is similar to the applicator 70.

Obvious changes and modifications will become apparent to those of ordinary skilled in the art. For example, the partition wall may be eliminated and the product permitted to flow freely into the space between the comb portion and the base portion. The array of tines may be varied, and the number of hollow tines and/or solid tines may be varied, as well as varying the length of the tines. Similarly, the configuration of the applicator may take any shape. The comb portion and base portion are preferably molded of plastic, though may be formed of other suitable materials. The partition wall may be formed on the base portion rather than the comb portion, or on both portions, or the partition wall may be eliminated entirely.

Another embodiment of dispensing device according to the principles of the present invention is shown in Figures 14-17. The dispensing device 100 is removably attachable to a pair of containers 12a,12b similar to those described above in connection with the embodiment of Figures 1-4. The dispensing device 100 comprises an applicator or dispensing head 110, a mixing chamber 120 formed in the dispensing head 110, and an actuator 140.

The applicator or dispensing head 110 is shown in Figures 16-17 and comprises two complementary parts or sections 111,112, which are preferably molded of a relatively rigid opaque plastic material. The two sections 111,112 are bonded together by an adhesive or other suitable bonding agent to form a unitary dispensing head structure. The dispensing head 110 has a generally inverted Y-shaped configuration having two arm portions and

a leg portion. The two arm portions terminate in cylindrical recesses 113a,113b which communicate through inlet ducts 114a,114b to an inlet region of the mixing chamber 120. As described below, the cylindrical recesses 113a,113b receive therein cylindrical portions 146a,146b of the actuator 140 for supplying the constituents from the containers 12a,12b to the mixing chamber 120 via the inlet ducts 114a,114b.

The mixing chamber 120 has a tortuous, sinuous flow path for flowing the constituents from the inlet region 121 through an outlet 122 of a nozzle tip portion 123 of the dispensing head 110. The sinuous flow path is formed by wall portions of the two sections 111, 112 of the dispensing head 110, as best shown in Figures 16 and 17. In this embodiment, each of the two sections 111,112 has wall portions 125 which extend toward complementary wall portions of the other section so that when the two sections 111,112 are attached together, the respective wall portions of the two sections align with and abut one another to form the sinuous flow path. Stated otherwise, each section 111,112 has a sinuous recessed portion that mates with a complementary sinuous recessed portion of the other section so that when the two sections are connected together, the two sinuous recessed portions align with one another and jointly define the sinuous flow path.

To increase the intermixing of the constituents during their flow through the tortuous flow path of the mixing chamber 120, the mixing chamber is provided with a plurality of baffle mixing stations as shown in Figure 16. For ease of illustration, Figure 16 shows the section 112 of the dispensing head 110 from the same direction as viewed in Figure 14 but with the section 111 removed to show the internal construction of the mixing chamber 120. Each baffle mixing station comprises a baffle member 128 positioned in the middle of the flow path and extending at substantially right angles to the wall portions which

define the flow path, followed by a narrow passageway formed by two baffle members 129 attached to opposed portions of the wall portions. The baffle members 128,129 are preferably formed by molding at the same time, and in the same manner, as are formed the wall portions 125. The baffle mixing stations are disposed along substantially the entire length of the sinuous flow path and function to effect systematic mixing of the constituent mixture as it flows through the mixing chamber 120. Each baffle mixing station creates turbulent local mixing of the constituents so that the mixture of constituents becomes progressively and increasingly uniform and homogeneous as it flows along the sinuous flow path. While ten baffle mixing stations are illustrated, any number of such stations may be used depending on the viscosity and other properties of the constituents, the length of the sinuous flow path, and other factors which would be readily known to those skilled in the art. Also, the spacing between the upstream baffle member 128 and the adjacent downstream baffle members 129 as well as the size of the passageway defined by the baffle members 129 may be suitably varied depending on the properties of the constituents.

To further increase the mixing effect, a baffle member 130 is preferably positioned in the inlet region of the mixing chamber 120 where the inlet ducts 114a,114b open into the mixing chamber. The baffle member 130 effectively creates flow separation and turbulence of the constituents entering the mixing chamber 120 and allows the constituents to be initially mixed together instead of flowing side by side as they begin their flow through the mixing chamber 120.

Referring to Figures 14 and 15, the actuator 140 is preferably a one-piece, molded plastic structure having a peripheral skirt portion 142 designed to releasably engage with upper lips of the containers 12a,12b, preferably in a snap-fit engagement, to thereby removably

attach the dispensing head 110 to the containers. In this embodiment, the containers 12a,12b are housed in a casing 102 which holds the containers stationary relative to one another and facilitates use of the dispensing head 110. A manually depressible actuating portion 144 is connected to the skirt portion 142 by a pair of flexible hinges 143 so that the actuating portion 144 may be displaced downwardly and upwardly relative to the skirt portion 142. The actuating portion 144 is provided with two upstanding cylindrical portions 146a,146b. The outer peripheries of the cylindrical portions 146a,146b are dimensioned to be inserted with a snap-fit into respective ones of the cylindrical recesses 113a,113b of the dispensing head 110. Each of the cylindrical portions 146a,146b is provided with an internal stepped bore dimensioned to receive therein with a snap fit respective ones of the valve members 18,18 of the containers 12a,12b when the dispensing head 110 is attached to the containers. By such a construction, when the actuating portion 144 is manually depressed, the valve members 18,18 of the containers 12a,12b are displaced downwardly to thereby simultaneously release the pressurized constituents from the two containers. A description of the manner of operation of the valve members 18 has been omitted here, reference being had to the detailed description thereof given above with reference to the embodiment of Figures 1-4.

In operation, when it is desired to mix together the constituents of two containers, such as the containers 12a,12b, the dispensing device 110 is snap-fit over the valve members 18,18 of the two containers with the peripheral skirt portion 142 in snap-fit engagement with the upper lips of the containers. Means other than the peripheral skirt portion 142 may be employed to maintain the dispensing device 110 attached to the containers 12a,12b, or reliance may be had solely on the snap-fit engagement of the dispensing device 110 with the valve

members 18,18 of the containers. When the user manually depresses the actuating portion 144, the valve members 18,18 are displaced downwardly, thereby opening the valves and permitting the pressurized constituents from the containers 12a,12b to flow through the inlet ducts 114a,114b into the mixing chamber 120. When the two constituent flows enter the inlet region of mixing chamber 120, the flows are interrupted by the baffle member 130, which creates flow separation and turbulent intermixing of the constituents. The constituent mixture then flows along the sinuous flow path of the mixing chamber 120, successively passing the baffle mixing stations disposed along the flow path. The baffle mixing stations create local turbulence, forcing the mixture to become increasingly uniform and homogeneous as it travels along the length of the flow path to the outlet opening 122 from which the uniform mixture is dispensed. When the user releases manual depression of the actuating portion 144, the valve members 18,18 close, thereby terminating the outflow of constituents from the containers 12a,12b.

As will be readily apparent to those of ordinary skill in the art, the length of the mixing chamber and the number of baffle mixing stations as well as the sizes of the narrow passageways defined by the baffle members 129 may vary depending on the viscosity and other properties of the constituents. The baffle members 129 may be inclined rather than perpendicular to the wall portions 125, and the center baffle member 128 may be omitted, depending on the properties of the constituents and other factors. The dispensing rate of the constituent mixture can easily be adjusted by changing the propellant used in the aerosol containers or the valve and mixing chamber specifications. Also, the invention is not limited to two containers, and the applicator or dispensing head 110 can be modified to accommodate three or more containers whose constituents are to be mixed together.

Obvious modifications and changes may be made to the embodiments described herein, and the present invention is intended to cover all such obvious modifications and changes which fall within the spirit and scope of the appended claims.